



INFINITY CAPTURE IMAGING SOFTWARE

User's Manual

7 Capella Court, Ottawa, ON, Canada K2E 8A7
Phone: 1.613.736.4077 Fax: 1.613.736.4071 www.lumenera.com



Copyright Notice:

Release 4.5

Copyright © 2007 Lumenera Corporation. All rights reserved.

The contents of this document may not be copied nor duplicated in any form, in whole or in part, without prior written consent from Lumenera Corporation. Lumenera makes no warranties as to the accuracy of the information contained in this document or its suitability for any purpose. The information in this document is subject to change without notice.

License Agreement (Software):

This Agreement states the terms and conditions upon which Lumenera Corporation ("Lumenera") offers to license to you (the "Licensee") the software together with all related documentation and accompanying items including, but not limited to, the executable programs, drivers, libraries, and data files associated with such programs (collectively, the "Software").

The Software is licensed, not sold, to you for use only under the terms of this Agreement.

Lumenera grants to you the right to use all or a portion of this Software provided that the Software is used only in conjunction with Lumenera's family of products.

In using the Software you agree not to:

- a) decompile, disassemble, reverse engineer, or otherwise attempt to derive the source code for any Product (except to the extent applicable laws specifically prohibit such restriction);
- b) remove or obscure any trademark or copyright notices.

Limited Warranty (Hardware and Software):

ANY USE OF THE SOFTWARE OR HARDWARE IS AT YOUR OWN RISK. THE SOFTWARE IS PROVIDED FOR USE ONLY WITH LUMENERA'S HARDWARE AND OTHER RELATED SOFTWARE. THE SOFTWARE IS PROVIDED FOR USE "AS IS" WITHOUT WARRANTY OF ANY KIND. TO THE MAXIMUM EXTENT PERMITTED BY LAW, LUMENERA DISCLAIMS ALL WARRANTIES OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABILITY, QUALITY AND FITNESS FOR A PARTICULAR PURPOSE. LUMENERA IS NOT OBLIGATED TO PROVIDE ANY UPDATES OR UPGRADES TO THE SOFTWARE OR ANY RELATED HARDWARE.

Limited Liability (Hardware and Software):

In no event shall Lumenera or its Licensor's be liable for any damages whatsoever (including, without limitation, incidental, direct, indirect, special or consequential damages, damages for loss of business profits, business interruption, loss of business information, or other pecuniary loss) arising out of the use or inability to use this Software or related Hardware, including, but not limited to, any of Lumenera's family of products.

Product Warranty

Lumenera Corporation warrants to the original purchaser that our cameras are guaranteed to be free from manufacturing defects for a period of one (1) year from the original date of purchase.

Should the unit fail during the warranty period, Lumenera will, at its option, repair or replace the failed unit. Repaired or replaced units will be covered under warranty for the remainder of the original one (1) year warranty period.

This warranty does not apply to units that, after being inspected by Lumenera, have been found to have failed due to customer abuse, accidents, mishandling, tampering/alteration, improper installation, improper power source, negligence, opening of the enclosure, or if the serial number has been removed or damaged. This warranty does not cover labor or incurred charges required in removing or installing the unit, any business interruption, loss of profits/revenues, or any consequential damages.

Units returned to Lumenera beyond the warranty period will be repaired, if possible, and all appropriate material and labor charges will apply.

Any returning product, specifically those being returned under warranty, must follow the Returned Material Authorization (RMA) process. Any units being returned are to be properly packaged (in original packing – if possible). Lumenera will not cover damage sustained in shipping due to improper packing.

For RMA instructions, please refer to our website at www.lumenera.com.

RoHS/WEEE Compliance Statement

The Restriction of Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive was passed into law by the European Union (E.U.). It affects manufacturers, sellers, distributors and recyclers of electrical and electronic equipment containing lead, cadmium, mercury, hexavalent chrome, polybrominated biphenyl (PBB) and polybrominated diphenyl ether (PBDE). After July 1, 2006 the use of these materials will be banned in new products sold in Europe. The RoHS Directive complements the WEEE Directive. China is expected to adopt similar legislation within a similar timeline.

The Waste Electrical and Electronic Equipment Directive (WEEE) aims to reduce the waste arising from electrical and electronic equipment and to improve the environmental performance of all those involved in the life cycle of these products.

Lumenera is committed to protecting people and the environment and we are working on identifying any materials used in our processes that could pose a potential hazard to our employees, customers or the environment.

For this reason we are committed to have all our products comply with the RoHS and WEEE directives. We are constantly improving our compliance with these directives. For more information on our compliance or to track our progress please refer to our website.

Trademarks and Proprietary Names:

Lumenera Scientific, INFINITY X, INFINITY 1, INFINITY 2, INFINITY 3, INFINITY 4, INFINITY 5, INFINITY1, INFINITY2, INFINITY3, INFINITY4 and DeltaVU are trademarks of Lumenera Corporation. This manual may refer to other product names, which may be trademarked by their respective companies, and are used herein for identification purposes only.

Federal Communications Commission (FCC) Statement

This equipment has been tested and found to comply with the limits of a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment. This equipment generates, uses, and radiates radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference. However, there is no guarantee that interference will not occur. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician.

Any changes or modification to said product not expressly approved by Lumenera could void the user's authority to operate this device.

Shielded and grounded cables and connectors must be used to meet FCC emission limits. Lumenera takes no responsibility for any radio or television interference caused by using cables or connectors other than those recommended.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

European Community (CE) Statement

Products: INFINITY 1, 2, 3, 4, 5, X, Lu1175, Lu1175X, Lu1205, Lu1135, Lu1165, Lw1235, Lu1275, Lu1335, Lu1375 and Lw1625 USB Scientific Cameras.

Directives: 2001/59/EC (General Product Safety Directive) Self-declared 89/336/EEC (EMC Directive).

Standards to which conformity is declared: EN55024: 1998
EN55022: 1998 (Class B)
EN61000-3-2: 1995
EN61000-3-3: 1995

Manufacturer's Name and Address: Lumenera Corporation
7 Capella Court
Ottawa, ON
K2E 8A7
Canada

Type of Equipment: USB 2.0 Scientific Digital Camera

First Year of CE Conformity: 2003

This is to certify that the Lumenera USB 2.0 Scientific Cameras meet or exceed the standards for CE compliance per the Council Directives noted above. All equipment is built at Lumenera Corporation, and pertinent testing documentation is available for verification.

Table of Contents

COPYRIGHT NOTICE:	I
LICENSE AGREEMENT (SOFTWARE):	I
LIMITED WARRANTY (HARDWARE AND SOFTWARE):	I
LIMITED LIABILITY (HARDWARE AND SOFTWARE):.....	I
PRODUCT WARRANTY.....	I
ROHS/WEEE COMPLIANCE STATEMENT	II
TRADEMARKS AND PROPRIETARY NAMES:	II
FEDERAL COMMUNICATIONS COMMISSION (FCC) STATEMENT.....	III
EUROPEAN COMMUNITY (CE) STATEMENT	III
INTRODUCTION.....	1
1.1 THE LUMENERA INFINITY CAMERA FAMILY	1
GETTING STARTED.....	2
2.1 SOFTWARE INSTALLATION	2
2.1.1 <i>Minimum System Requirements</i>	2
2.1.2 <i>Camera Power Requirements</i>	2
2.1.3 <i>Installation Procedure</i>	2
2.1.4 <i>Software Upgrade Procedure</i>	4
2.2 TECHNICAL ASSISTANCE	4
2.3 INSTALLED SOFTWARE	4
2.4 THE INFINITY CAMERA.....	5
USING THE CAMERA	7
3.1 INFINITY CAPTURE	7
3.2 LAUNCHING THE APPLICATION	7
3.2.1 <i>Main Window</i>	7
3.3 SELECTING IMAGE SIZE	8
3.3.1 <i>Image Preview Size</i>	8
3.3.2 <i>Capture Resolution</i>	9
3.4 IMAGE OPTIMIZATION	10
3.4.1 <i>Exposure</i>	10
3.4.2 <i>Gain</i>	10
3.4.3 <i>Selecting the Light Source</i>	11
3.4.4 <i>White Balance Target</i>	12
3.4.5 <i>White Balance</i>	13
3.4.6 <i>Hue and Saturation</i>	16
3.4.7 <i>Contrast / Brightness / Gamma</i>	16
3.5 CAPTURING AN IMAGE	17
3.5.1 <i>Capture Image</i>	17
3.6 OTHER OPTIONS	19
3.6.1 <i>Light Source Frequency</i>	19
3.6.2 <i>Preview Quality</i>	19

3.6.3	<i>Preview Zoom Level</i>	19
3.6.4	<i>Flat Field Correction</i>	19
3.6.5	<i>Image Flipping</i>	20
3.6.6	<i>Multiple Image Averaging</i>	20
3.6.7	<i>Multiple Image Settings</i>	20
3.6.8	<i>Preview Histogram</i>	21
3.6.9	<i>Highlight Saturated Pixels</i>	21
3.6.10	<i>Bitmap Overlay</i>	21
3.6.11	<i>Keep Main Window On Top</i>	23
3.6.12	<i>Load Camera Settings / Save Settings / Save Settings As</i>	23
3.6.13	<i>Restoring The Main Dialog Position</i>	23
3.6.14	<i>Restoring The Live Preview Dialog Position</i>	24
3.6.15	<i>Restoring The Image Preview Dialog Position</i>	24
3.6.16	<i>Auto-Saving Captured Images</i>	24
3.6.17	<i>INFINITY3 Camera Cooler Control</i>	26
3.6.18	<i>AVI Capture Settings</i>	27
3.6.19	<i>Capturing AVI files</i>	28
3.6.20	<i>AVI File Playback</i>	29
3.6.21	<i>Converting AVI files</i>	29
3.7	<i>USING INFINITY CAMERAS WITH TWAIN</i>	30

1

Introduction

1.1 The Lumenera INFINITY Camera Family

Lumenera INFINITY cameras are designed to be flexible microscopy imaging tools for Clinical, Research, Life Science, Materials Science and Educational Professionals. INFINITY cameras are compatible with any USB 2.0 equipped desktop, laptop or embedded computer running Microsoft Windows 2000 or XP.

INFINITY cameras are designed with flexibility in mind. Each camera model has its own distinct advantage over the others. Whether your application demands speed, resolution or sensitivity, there is an affordable INFINITY camera to meet the requirements. Because they are USB based, there is no need for a frame grabber. Instead, a single cable provides power*, full command and control and data transfer at speeds of up to 40 MB/s resulting in real-time video preview.

All cameras have a provision to be externally powered for cases where the USB cable does not supply power (e.g. some USB cards on laptop computers.)

The INFINITY cameras have undergone a recent naming change. The following table provides a cross reference between the old and new names:

Old Name	New Name
INFINITY 1	INFINITY1-1
INFINITY 2	INFINITY2-1
INFINITY 3	INFINITY1-3
INFINITY 4	INFINITY2-3
INFINITY 5	INFINITY3-1

* The original INFINITY 2, 4, 5 and X models should be used with an external 6V power adapter (supplied) due to their higher current requirements.

* The new INFINITY2-1, 2-2, 2-3, 3-1, 4-11 should be used with an external 5V power adapter (supplied) due to their higher current requirements.



Getting Started

2.1 Software Installation

The INFINITY camera you have just purchased is designed to operate out of the box with minimal set-up.

Note: Prior to plugging the camera into the computer, you must first install the software.

The software can be found on the CD-ROM that shipped with your product.

2.1.1 Minimum System Requirements

- Windows 2000 (Service Pack 4), or
- Windows XP (Service Pack 2)
- 600 MHz Pentium III or higher (compatible)
- 256 MB RAM minimum, 512 MB recommended
- USB 2.0 Port.

Note: A USB 2.0 Port is required. The camera will not work on a standard USB 1.1 port.

2.1.2 Camera Power Requirements

The camera can typically run off of the USB bus. In some cases and/or camera models, there may be a need to externally power the camera. Please refer to Section 1.1 for more information on selecting the appropriate power supply for your camera. If an incorrect external power supply is used, it could damage the camera and void your warranty.

2.1.3 Installation Procedure

The INFINITY camera you have just purchased is designed to operate straight out of the box. **However, prior to plugging the camera into the computer it is recommended that you first install the software**, which is included on the CD-ROM that shipped with your product. Follow the steps below for simple installation:

Installation Steps:

1. **If you are using a 3rd party USB 2.0 PCI add-in card, please ensure the add-in card is properly installed on your computer before proceeding.**
2. You must ensure you are logged into the computer with administrator privileges prior to continuing the installation.
3. Close all application software that is running and then insert the INFINITY Installer CD into your CD-ROM drive.
4. Double-click on "setup.exe", or wait a few moments for the auto-play function to load the setup program automatically.
5. Follow the onscreen prompts to install the software drivers and user application.
6. After the software has been installed, plug the INFINITY camera into a free USB 2.0 High-Speed port.
7. **Windows 2000 & XP Users:**
 - a. The Window's New Hardware Wizard will pop-up detecting a new "INFINITY Unconfigured Device". Select "Install the software automatically" from the options that are presented to you and click Next. A warning may appear notifying you that the drivers have not been digitally signed by Microsoft. Click Continue Anyway to continue with the driver installation. Then click Finish to install the drivers.
 - b. After a few seconds the Window's New Hardware Wizard will pop-up again (if it doesn't, unplug and re-plug the camera device), detecting a "INFINITY USB 2.0 Camera" device. Select "Install the software automatically" from the options that are presented to you and click Next. A warning may appear notifying you that the drivers have not been digitally signed by Microsoft. Click Continue Anyway to continue with the driver installation. Then click Finish to install the drivers. (Please Note: Depending on the camera model purchased the string "USB 2.0" may be different than noted above.
 - c. **Important:** Windows will ask you to re-run these steps each time you plug the camera into a **new** USB 2.0 port. You must have administrator privileges the first time the camera is used on any given USB 2.0 port. You may wish to repeat these installation steps at this time for all USB 2.0 ports.
8. Run the INFINITY CAPTURE application software from your Start menu to control the camera.

2.1.4 Software Upgrade Procedure

The Software Upgrade procedure is similar to the original software installation. If you have installed a previous version of the software the installation procedure will detect the previous software version and indicate that an upgrade will be performed.

2.2 Technical Assistance

If you need assistance with the installation or use of the software, or, if you need help with general camera operation, please contact your retailer or dealer first. If you still need assistance you can contact the Technical Assistance Centre (TAC) via email at:

support@lumenera.com

or by phone at +1-613-736-4077 (press 2 from the auto attendant)

To obtain the latest software release and other technical information you may visit our technical support website at:

<http://www.lumenera.com/support/index.php>

Our support website contains technical information available to the general public such as Frequently Asked Questions (FAQ's). For our Lumenera customers we provide a Knowledge Base with more product specific solutions and a Download Centre for customers to obtain the most recent software releases.

As a customer, you will need to provide the TAC with some basic information to gain access to the customer Knowledge Base and the Download Centre. Please provide the following details via email to support@lumenera.com to obtain a user name and password:

- Your name, Company Name, address and telephone number
- Your camera model and serial number
- Your purchase information (e.g. did you purchase from an OEM or distributor?)

Upon providing the above information, you will receive your access information via email from a TAC representative.

2.3 Installed Software

All of the necessary software and device drivers are contained in an installation program on the CD-ROM that comes with the camera.

The following files are installed when you run the installation program:

INFINITY CAPTURE Application: Lumenera provides a free, easy to use capture application with all of the features required for basic camera functionality and image capture.

INFINITY ANALYZE Application: Included on this CD is Lumenera's new INFINITY ANALYZE software. The new INFINITY ANALYZE software provides advanced camera control, measurement functions and image enhancement options including stitching, annotation and archiving. The application has extensive context sensitive help for all its features.

INFINITY TWAIN Interface: A plug-in driver will be installed by the installation program that will allow all INFINITY cameras to be used with any 3rd party software application that supports a TWAIN device.

INFINITY DirectShow Interface: Filter drivers will also be installed by the installation program that will allow all INFINITY cameras to be used with any 3rd party software application that supports DirectShow / DirectX / WDM capture devices.

2.4 The INFINITY Camera

All INFINITY cameras have a power jack and a high-speed USB port found on the back of the camera. After powering the camera, simply plug it into a USB 2.0 (high-speed) compatible port and the camera will be functional. An LED light between the power jack and USB port will indicate power is reaching the camera and that the camera is running.

The INFINITY 1, 1-1, 3, 1-3 and 1-5 can be powered via the USB cable alone, which nominally supplies 5 volts. For these models, the power adapter is only required in cases where the USB cable does not supply power (as is the case with some laptops.)

For all other INFINITY models, the supplied power adapter should be used to power the camera, as the power supplied by the USB bus is not sufficient for optimum performance.

The power adapter supplied* has the following specifications:

1. 5, 6 or 12 Volts DC Regulated (Depending on Model)
2. 500-3000 mA Minimum Current Rating (Depending on Model)
3. 2.1 mm tip, Center positive (+)

The camera is equipped with an industry standard C-Mount lens mount, which is compatible with standard C-Mount lenses or microscope mounts. The INFINITY4-11 comes equipped with an F-Mount instead of a C-Mount. An adapter may be necessary for microscopes that do not have this type of camera

mount. In some cases, a C-mount adaptor may be required to optimize the field of view between your microscope's eyepieces and the image viewed on the computer monitor. Your sales representative will recommend an adaptor to suit your requirements.

The INFINITY X camera is unique in that it utilizes DeltaVU™ a patent-pending technology that increases the resolution of captured images to as much as 21 megapixels (5120 x 4096) with true non-interpolated color at each pixel location.

**Power adapter not included for client's outside North America.*

3

Using the Camera

3.1 INFINITY CAPTURE

INFINITY CAPTURE is a powerful and flexible yet simple software application for the Live Preview, Optimization and Capture of digital images from any of the INFINITY cameras.

It is supported by Windows and has a graphical user interface with standard pull down menus, an icon based toolbar and keyboard commands, which make it very simple to control the camera and take images.

The following sections describe the usage of the software and explain the various camera settings and how they relate to the changes viewed in the live and captured images.

3.2 Launching the Application

To launch INFINITY CAPTURE from your Windows Start menu:



Select: Programs > INFINITY Camera > INFINITY Capture.

(If you installed the software in a different location, the above instruction will be different based on the location you chose.)

Only one camera may be controlled by each instance of INFINITY CAPTURE, but several instances of the application may be run simultaneously. If more than one camera is detected by the application, a list of cameras and their corresponding serial numbers is displayed allowing you to select the camera you wish to control.

3.2.1 Main Window

The main window can be seen in Figure 1. When INFINITY CAPTURE starts up, the program's live preview window also starts. The main window has the toolbar with the most common program actions available for quick access.

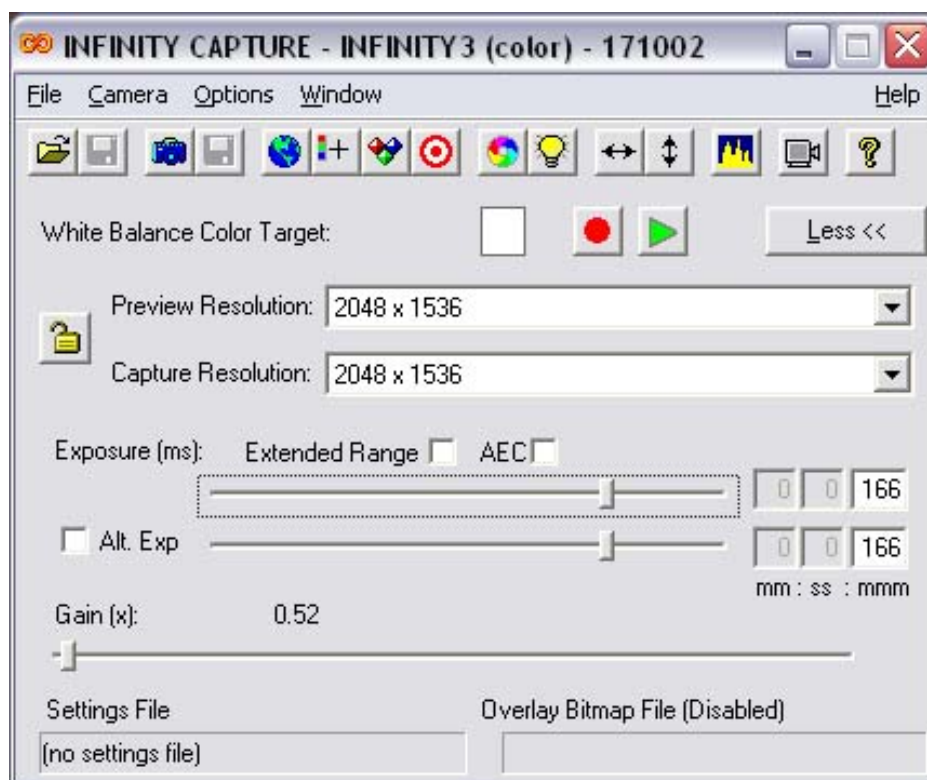


Figure 1 - INFINITY Camera Main Window

3.3 Selecting Image Size

3.3.1 Image Preview Size

You may choose any one of the available resolution settings from the drop down list on the main window for video preview as depicted in Figure 2. Depending on the camera model, the available selections will be different. The default resolution on start up is 640 x 480. The video frame rate displayed on your monitor will vary depending on the choice of preview resolution. With each step down in resolution, you will utilize a smaller area of the camera's sensor (smaller field of view) resulting in less video data and increased frame rates. The exception to this is the sub-sampled mode, which utilizes the entire area of the sensor (full field of view) but skip rows and columns of pixels to reduce the amount of image data. In some cameras, a binned mode is available which works in a similar way to the sub-sampled mode except the pixels are summed together to produce a brighter, more sensitive image. Using this mode results in a megapixel image area at higher frame rates but with less detail. Note: some camera models only provide a monochrome output when operating in a binning mode.

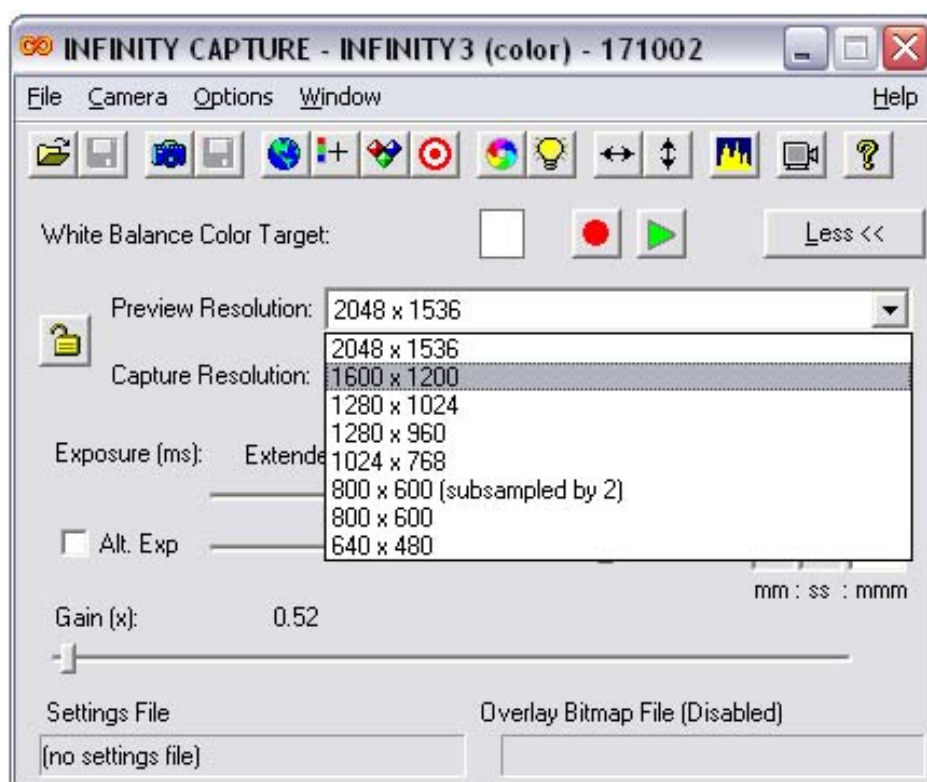


Figure 2 - Image Preview Size

3.3.2 Capture Resolution

Image capture resolution is selected through the drop down list in the main window similarly to the Image Preview Size. Capture resolution is independent of preview resolution. This represents the resolution of the image that is captured.

The INFINITY X camera has 4 different DeltaVU™ resolutions available for each preview resolution (in addition to the standard “Demosaic” method used by all other cameras.) This patent pending technology allows for much higher resolution captures by performing sub-pixel shifting of the imager.

The preview and capture resolutions can be locked so that they both change when changing either one.



Figure 3 - Resolution lock

3.4 Image Optimization

3.4.1 Exposure

Optimizing the exposure of your INFINITY camera is achieved through moving the exposure slider, Figure 4. Based on the camera model, you have different exposure ranges available. Fine exposure slider adjustments can be made using the left and right arrow keys on your keyboard when the exposure slider is selected. As exposure is adjusted, the frame rate is kept at the maximum possible.

Some cameras have an extended exposure range, indicated by an Extended Range check box just above the exposure slider. When not in extended exposure mode, the exposure is limited but has high granularity so that very precise exposure settings can be made. When the option is selected, the exposure can be increased to the maximum allowed by the camera, but with less granularity.

Note: If you have image averaging turned on and are using long exposures, you may have to wait a long time to capture an image. Also, when using very long exposures (several seconds) especially with high gain, noise may be present in the image in the form of random hot pixels and vertical bars. These can be minimized by using the flat field correction function of the application.

3.4.2 Gain

Adjusting the global electronic gain of your INFINITY camera increases the sensitivity without increasing the exposure. The slider is under the exposure slider on the main window as depicted in Figure 4. The global gain of each INFINITY camera model is optimized on start up. General image quality may decrease as the gain is adjusted upward because the noise in the image is also amplified along with the image signal.

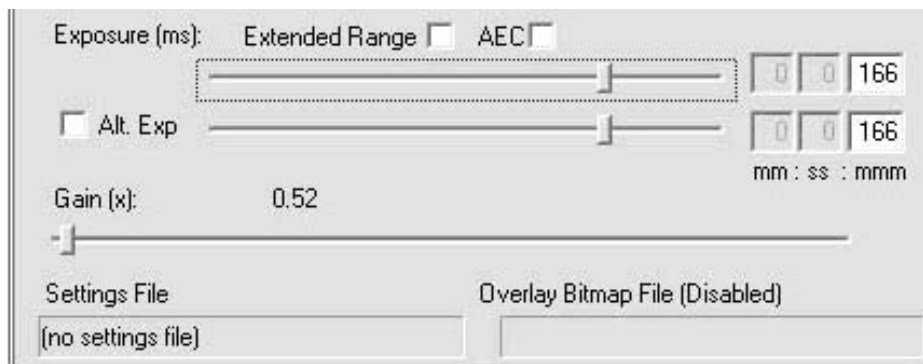


Figure 4 - Exposure and Gain Control

Note: When using very long exposures (several seconds) especially with high gain, noise may be present in the image in the form of random hot pixels and vertical bars. These can be minimized by using the flat field correction function of the application.

3.4.3 Selecting the Light Source

Each light source emits light at a specific frequency resulting in a specific color temperature. Color temperature measurement is typically referred to in degrees Kelvin (K). Warmer tungsten / Halogen light sources have temperature in the 3000 K range. Fluorescent light sources have a temperature in the 4000 K range and daylight conditions have cooler color temperatures in the 5500 K range.

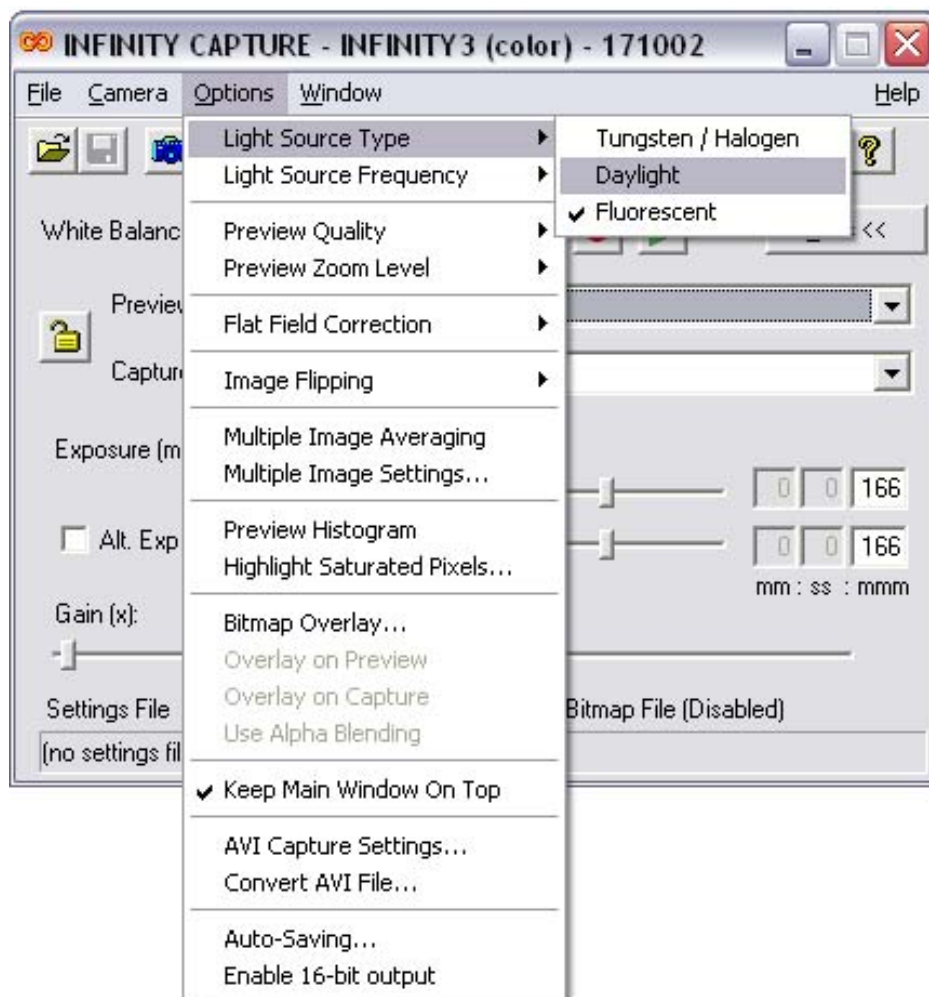


Figure 5 - Selecting the Light Source

Your INFINITY camera is set to Tungsten / Halogen as a default. Selecting the light source that best suits your working environment will help in optimizing your images.

From the Options menu, you can select the light source as depicted in Figure 5. Select Tungsten / Halogen for microscopy applications. When working in the field, outdoor lighting conditions with a standard lens, select the Daylight source. When working indoors, office environment with fluorescent lighting, select the Fluorescent source.

If you are using filters on the light source, you should choose the light source that best matches the filter. For example, on a microscope with Tungsten lighting, if you use the standard daylight filter, you should select Daylight as the light source.

3.4.4 White Balance Target

Your INFINITY color camera has the ability to adjust the colors in your image based on the current lighting conditions. In order to adjust and accurately represent the colors within your image, you must first perform a white balance.

As a first step, select a light source that accurately represents your working conditions, described above. Next, select a target color that most accurately represents the current working conditions. For a microscopy application this will be the background color when viewing a sample through the eyepieces.

The default target color on start-up is white and in most cases this is the desired choice. However, when viewing an image with the microscope eyepiece, especially when color filters are being used, the background color is sometimes non-white. If you want the colors captured by the camera to be as close as possible to the colors you see down the eyepiece you should select a color target from the Available White Balance Target Colors that closely matches the background color. The target color dialog can be accessed by selecting the “bull’s eye” icon from the toolbar or from the dropdown menu as depicted in Figure 6.

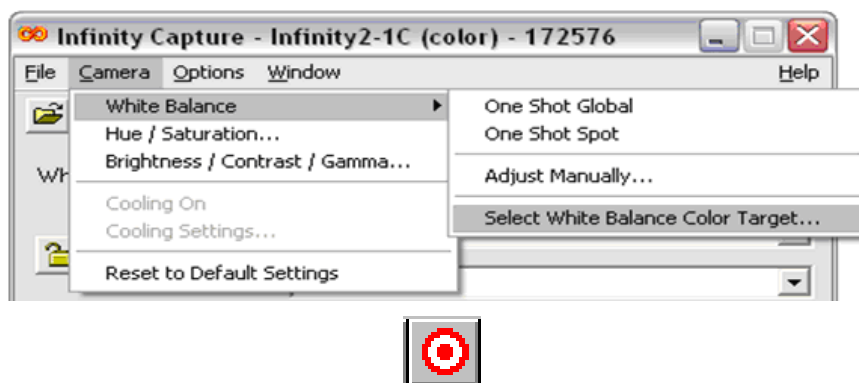


Figure 6 - White Balance Target Dialog Access

You can select a target color, simply by clicking or dragging the mouse pointer in the top window of the dialog depicted in Figure 7. The selected color appears in the bottom window. Alternatively, you can select the Red, Green and Blue values of the color.



Figure 7 - White Balance Target Dialog

3.4.5 White Balance

There are three methods available to adjust the white balance:

1. One Shot Global

This method balances the colors over the entire field of view. For best results, move your sample out of the field of view. If you are using a transmitted light microscope, move to a clear area of the slide. If operating a stereomicroscope, use the white base or a white piece of paper to represent the background. Perform the One Shot Global White Balance function by selecting the Globe icon from the toolbar, or by selecting One Shot Global from the Camera > White Balance drop down menu as depicted in Figure 8.

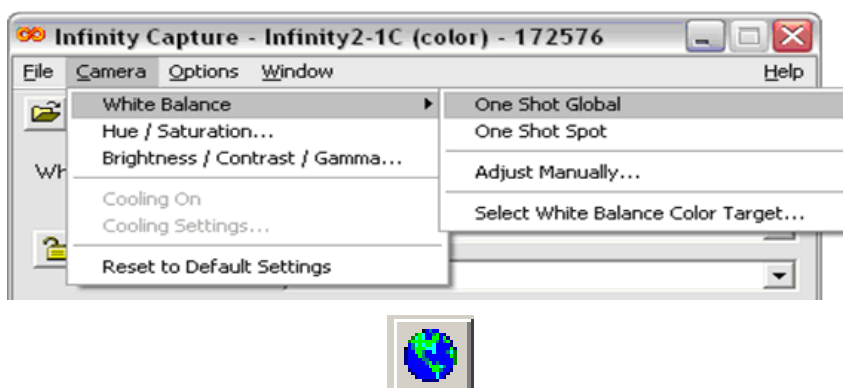


Figure 8 - White Balance / One Shot Global

2. One Shot Spot

Under certain circumstances, users may wish to adjust white balance based on a small area within the sample area. In these cases, One Shot Selection is the method of choice. To access the One Shot White Balance, select the crosshair icon from the toolbar, or select One Shot Spot from the camera drop down menu as depicted in Figure 9.

Once selected, move the cursor to the area of your image that you want to white balance (the mouse pointer changes to a cross hair when the mouse is in the image preview window) and select it. The size of the spot on the image used for the white balance is 32 x 32 pixels. You can cancel the operation prior to clicking on the image display by reselecting the icon or menu item.

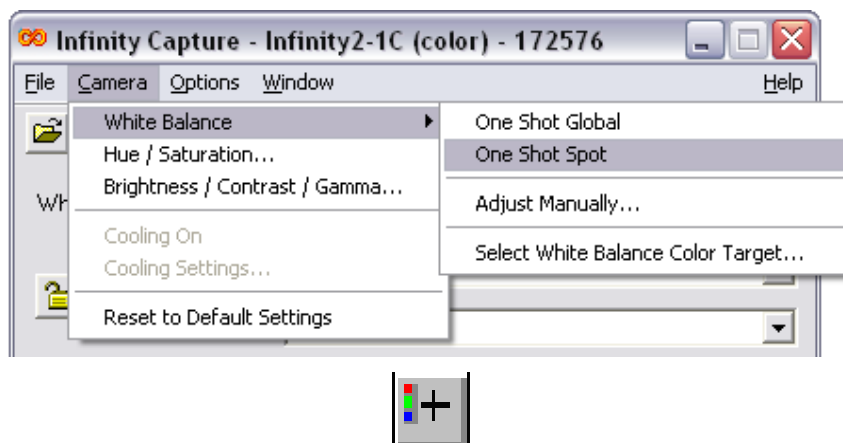


Figure 9 - White Balance / One Shot Spot

3. Adjust Manually

It is possible to manually adjust the color balance by changing the individual color gains. This is helpful where slight adjustments to the white balance are required or when the One Shot methods are unable to achieve a good balance. The sliders that control the red, green and blue gains can be accessed via the

tricolour icon on the toolbar or by selecting Adjust Manually from the Camera > White Balance drop down menu as depicted in Figure 10.

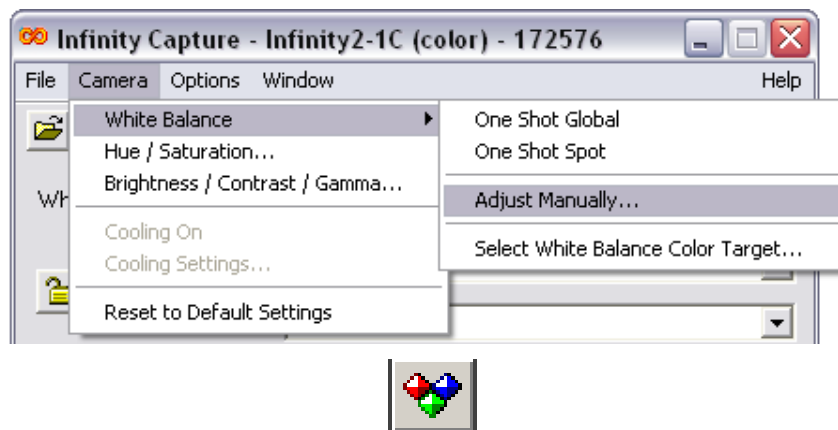


Figure 10 - White Balance / Adjust Manually

Not all cameras have a green gain adjustment. In those cases, simply adjust the Red and Blue gains together, higher to remove green and lower to add green. The gain values represent multiplicative factors. The Initialize button will set all gains to one and the Reset button will reset the gains to the values they had when the dialog was popped up.

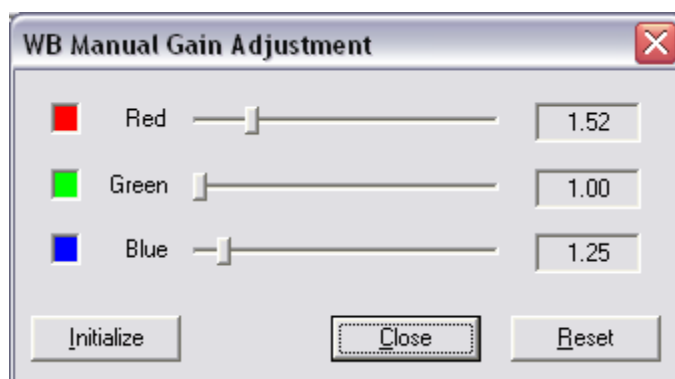


Figure 11 - Manual Gain Adjustment Dialog

Note: If you use an extreme white balance target color, a proper white balance may not be achievable using the one shot or manual methods. Likewise, under extreme lighting conditions (very warm or very cool) proper white balance may be difficult to achieve. In the latter case, try using a color filter to bring the light temperature closer to the daylight standard of 5500K.

3.4.6 Hue and Saturation

Hue is a term typically used to describe the tone in your image. Adjusting the hue changes the appearance of the image by shifting the color spectrum incrementally. It's not a substitute for white balance but can be used to give images a warmer or cooler tone.

Saturation typically refers to the dominance of color intensity within your image. A low saturation image looks dull and adding saturation can make the colors more vibrant.

The dialog for Hue/Saturation adjustment can be accessed via the rainbow icon on the toolbar or by selecting Hue/Saturation from the Camera drop down menu.

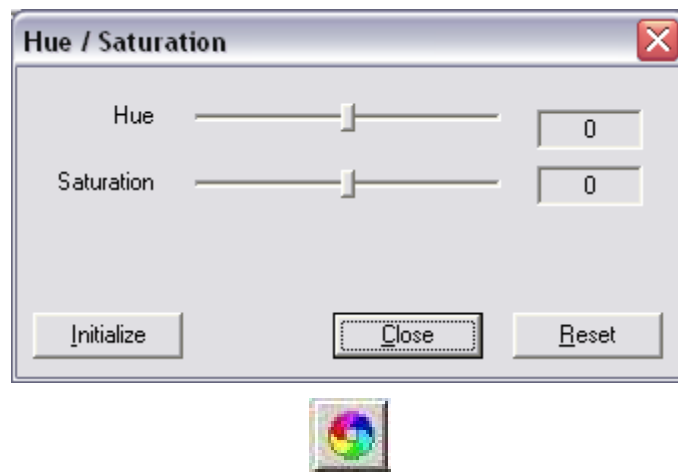


Figure 12 - Hue / Saturation Dialog

The sliders are used to adjust the hue and saturation, increasing when moved to the right and decreasing when moved to the left. By moving the saturation slider all the way to the left, all color is removed from the image making it appear monochrome or grayscale. The Initialize button will set the Hue & Saturation to zero and the Reset button will reset the Hue & Saturation to the values they had when the dialog was popped up.

3.4.7 Contrast / Brightness / Gamma

The dialog for Contrast/Brightness/Gamma adjustment can be accessed via the light bulb icon on the toolbar or by selecting Contrast/Brightness/Gamma from the Camera drop down menu.

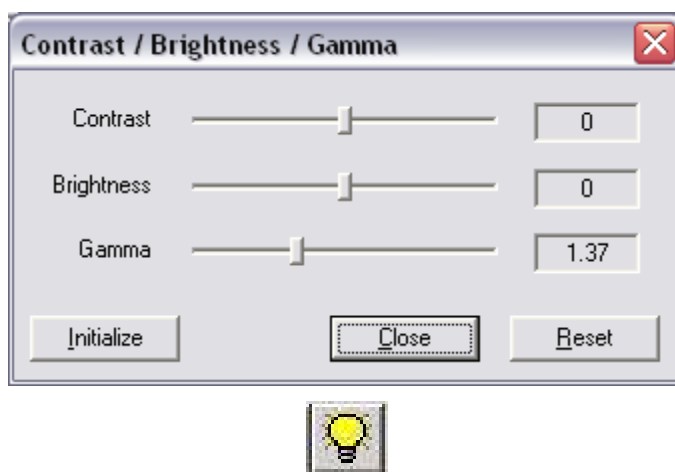


Figure 13 - Contrast / Brightness / Gamma Dialog

Adjusting the contrast affects the brightness relationship between the dark and light areas in your image. Adjusting the slider to the right increases contrast, making dark areas darker, bright areas brighter and eliminating brightness levels in between. Moving the slider to the left decreases contrast causing the brightness of the image to become more uniform and flat.

Adjusting the brightness affects the overall image intensity. Moving the slider to the right and left makes the image brighter and darker respectively.

Gamma adjustment affects the bright, dark and between areas of your image in a non-linear fashion. The purpose of gamma is to correct the non-linearity in most display devices. Gamma values greater than 1.0, will brighten the darker areas of an image without over brightening the bright areas. For most monitors, a good gamma value will lie in the range 1.3 to 2.0.

The Initialize button will set the Contrast and Brightness to zero and the Gamma to one. The Reset button will reset the Contrast, Brightness and Gamma to the values they had when the dialog was popped up.

3.5 Capturing an Image

3.5.1 Capture Image

There are two steps to capture and save an image.

- First, select if you want to set the camera into 16 bit mode by selecting this option from the Options menu
- Next, select the Capture Image Icon to capture the image and display it on screen.
- Finally, select the Save Captured Image Icon to save it to disk.

These commands are also available from the drop down menu.

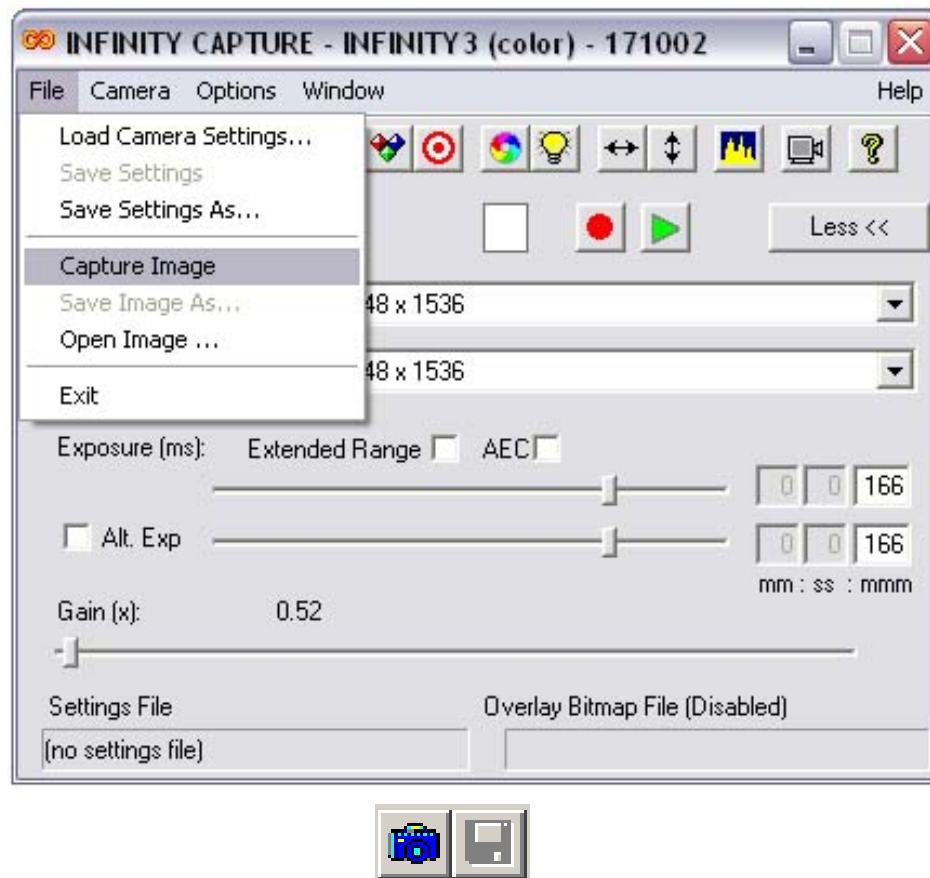


Figure 14 - Capture and Save Image

- You have a choice of four file types to select from when saving 8 bit images and two file types for 16 bit images. JPEG and Bitmap file types do not support 16 bit image saves. Note that JPEG images are compressed and there will be some loss of image detail with that format. All other formats are uncompressed with no loss of image detail. This application uses the default JPEG compression ratio provided by your Windows operating system. This application does not allow you to change this compression ratio.

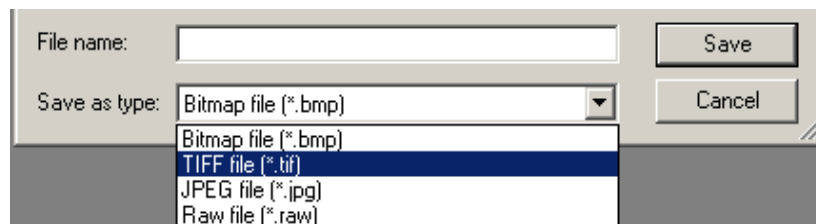


Figure 15 - Image Saving File Formats

3.6 Other Options

3.6.1 Light Source Frequency

The light source frequency settings simply limit the available exposure times that can be used in order to avoid the flickering or banding caused by lights operating on AC power sources. When using DC powered lights, as most microscopes have, the DC setting may be selected and there will be no restriction on the allowable exposures. When an AC power source is used for the illumination, the appropriate frequency should be selected from the choices 60 Hz or 50Hz.

Note: This option is disabled when AEC is turned on.

3.6.2 Preview Quality

The video displayed in the preview window can be set to either: "Optimize for Speed" or "Optimize for Quality". The default setting is for best image quality, which uses a higher percentage of the CPU and may result in a slightly slower video rate on some slower computers. When the "Optimized for Speed" option is selected, the image quality is noticeably poorer, but CPU usage is minimized and frame rates are always at their maximum. This setting does not affect how images are captured. Captured images always use the highest quality algorithms to process the raw data from the camera into full color images.

3.6.3 Preview Zoom Level

The preview window can be set to "Actual Size (100%)", which will display the full field of view at its actual size. Selecting "Half Size (50%)" will shrink the display 50% in each direction while maintaining the full field of view. This option is useful when previewing large resolutions that are larger than the monitor's display size. A digital zoom is applied to the camera output when zoom factors larger than 100% are selected. Whenever the preview image cannot fit on the computer monitor, the application adds scroll bars to the side and bottom of the window, for navigation. The available zoom factors are: 25, 50, 100, 200, 400, and 800%.

3.6.4 Flat Field Correction

3.6.4.1 Generate Image

Flat Field Correction is used to correct for uneven lighting and other fixed pattern non-uniformity in the image. This action is used to generate the correction to be applied to the image. Before selecting it, you should make all your imaging adjustments (exposure, gain, etc.) and then remove any sample from the field of view so that you only have an empty "background" image. Once the correction is generated, it can be applied using the "Enable Correction" option.

3.6.4.2 Load Image

Calibration images that have been previously collected can be restored using this function. Only calibration files that are known to be appropriate for the existing lens and illumination conditions should be loaded. If there have been any alterations to the optics or the lighting, a new flat field calibration should be performed.

3.6.4.3 Save Image

Use this function to save a flat field calibration image to disk, to be restored for use during another session, or after the lens and lighting conditions have been returned to the state when the calibration was performed

3.6.4.4 Enable Correction

This action applies the flat field correction that was generated in the previous action. When enabled, the correction will be automatically applied to both the live preview and the captured image. If you change the resolution of the preview, the correction will be reset and disabled. If you change the field of view, by selecting a different objective lens, for example, you should regenerate the correction for the new field of view.

3.6.5 Image Flipping



Image flipping (vertical) and mirroring (horizontal) are available from the Options drop down menu or the left-right, up-down arrow icons on the toolbar. Selecting these options will flip the preview image 180° either vertically or horizontally. This option also affects the captured image.

3.6.6 Multiple Image Averaging

This feature is accessed through the Options drop down menu. Image averaging is an effective tool to reduce random noise in your images. To enable this feature, you select the Multiple Image Averaging option from the Options Menu.

3.6.7 Multiple Image Settings

You can change the number of images that are averaged together using the Multiple Image Settings Dialog, which is accessed by selecting the Multiple Image Settings option in the Options menu.

When enabled, every time you capture an image the number of images you selected will automatically be collected and averaged together.

This feature is not supported by the INFINITY X when capturing high-resolution (DeltaVU™) images.

3.6.8 Preview Histogram



A real-time intensity histogram can be overlaid on the preview window. This histogram can be used as a guide to setting the image properties such that the full dynamic range of the image sensor is being utilized. To display the preview histogram, select Preview Histogram from the drop down Options Menu or select the histogram icon from the toolbar.

3.6.9 Highlight Saturated Pixels

This option allows you to highlight the pixels in the image that are at or near saturation. Saturation in this case refers to the brightness of the pixel. The upper 5% of pixel values will be changed to the selected color and as they get closer to their saturated value and will get progressively darker as they reach their saturation level.

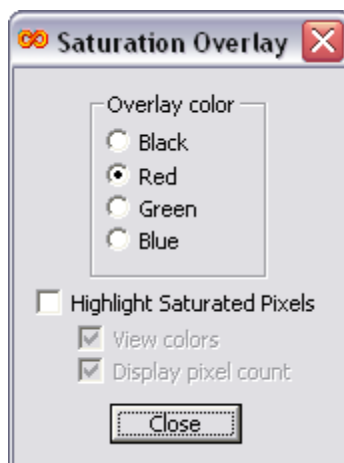


Figure 16 - Saturation Overlay Dialog

There are four highlight color options available for color cameras: black, red, green and blue, as shown in Figure 16. Only black highlights are available for monochrome cameras. A count of saturated pixels can also be presented in the video preview window by selecting the Display pixel count option.

To highlight saturated pixels and/or count them, you need to select the Highlight Saturated Pixel option on this dialog.

3.6.10 Bitmap Overlay

Any arbitrary bitmap can be overlaid on the live preview display or captured image. A set of digital reticles is included with the application that can be used for measurements or to aid object indexing and alignment. Figure 17 shows the Bitmap Overlay Control dialog box.

Once the bitmap is loaded, you select from the Options Menu to overlay on the preview image and/or the captured image.

You can also create your own bitmaps to overlay, using any paint program. The bitmap must have a width that is evenly divisible by four and must be in RGB24 format, but other than that, there are no restrictions. Any part of the bitmap that is pure white (RGB = 255, 255, 255) will be transparent with any other color overlaying and replacing the image data.

If the overlay is smaller than the preview or captured image, the overlay can be placed in nine specific locations using the Position radio buttons.

The overlay can be selected to appear on either the live preview or on the captured images, or both. The Options menu lists both of these options, and they are also available on the Overlay dialog.

The overlay can also take advantage of Alpha channel blending. The Alpha blending dictates how much of the image is seen through the overlay. You can make the overlay transparent, opaque or anywhere in between globally or use an Alpha blending bitmap file to use different blending values across the images.

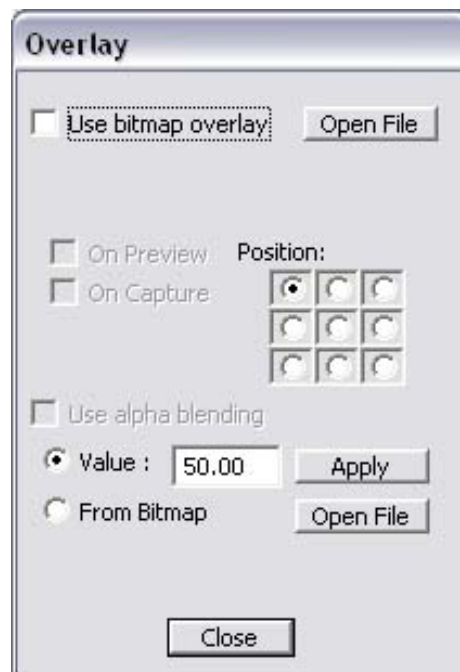


Figure 17 - Bitmap Overlay Control Dialog

An alpha blending bitmap can be used whenever an overlay bitmap is being used. This bitmap affects the way the overlay bitmap is actually overlaid. It is often undesirable to have the bitmap completely obscure the image data. The alpha blending bitmap will cause the overlay to blend with the image data making it less obtrusive. It can also be used to make a solid bitmap, like a logo for example, into a watermark that can be used to tag images without hiding the image underneath it.

The alpha bitmap has the same restrictions as the overlay bitmap, and must be the same size as the overlay bitmap. The way it works is as follows: The value of each pixel in the alpha bitmap indicates the level of transparency of the pixel at the same location in the overlay bitmap. Pixels that have a value of 255 are treated as completely transparent so that only the pixel from the original image is used. Pixels that have a value of zero are treated as completely opaque so that only the pixel from the overlay bitmap is used. The transparencies of the pixels in-between vary linearly with their value. The blending is done independently for each of the three color-channels (R, G & B), which allows for some interesting effects, such as changing the color of the overlay, not just blending it with the image.

The reticles bitmaps included with the application can be used as their own alpha blending bitmaps. If you use any one of the gray reticles, they will simply blend the colored reticles into the image to varying degrees. The dark gray will blend a little bit, the gray will blend half and half and the light gray will blend a lot. For interesting effects, try experimenting with using the color reticles as alpha bitmaps.

3.6.11 Keep Main Window On Top

This option forces the main application window to remain in front of all other windows on the desktop.

3.6.12 Load Camera Settings / Save Settings / Save Settings As



At any time, you can save the current settings of the camera and application to a file for later retrieval and use. When the application exits, it saves the current settings to a file that is automatically loaded the next time it is run. With your own settings files, you can quickly jump between different resolutions, exposures etc.

Save Settings, will save the settings to the currently loaded file (if it exists). Save Settings As, allows you to use a different file.

3.6.13 Restoring The Main Dialog Position

At any time, you can restore the location of the INFINITY CAPTURE main dialog on your desktop by selecting the Restore Main Dialog Position option of the Window menu, as shown in Figure 18. This option will move the dialog box back to the center of your desktop.

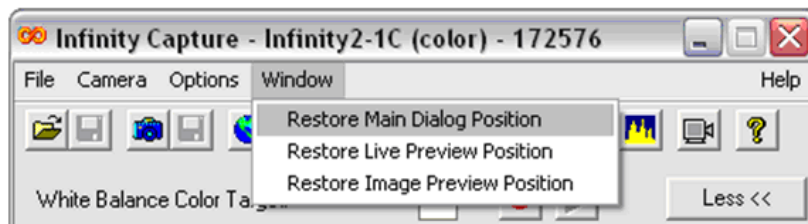


Figure 18 - Restore Main Dialog Position Option

3.6.14 Restoring The Live Preview Dialog Position

There may be times when you need to move the live preview window around on your desktop. You can restore its position by selecting the Restore Live Preview Position option from the Window menu. This option will move the live preview window to the upper left position of your desktop.

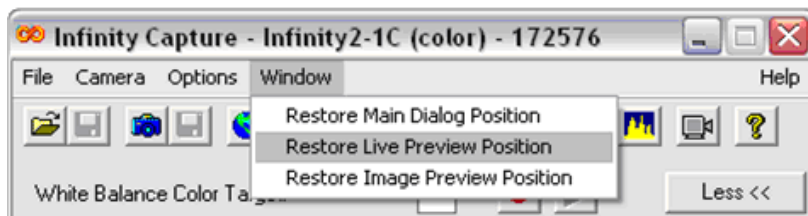


Figure 19 - Restore Live Preview Position Option

3.6.15 Restoring The Image Preview Dialog Position

There may be times when you need to move the image preview window around on your desktop. You can restore its position by selecting the Restore Image Preview Position option from the Window menu. This option will move the image preview window to the upper left position of your desktop.



Figure 20 - Restore Image Preview Position Option

3.6.16 Auto-Saving Captured Images

The auto-saving feature of the INFINITY CAPTURE application saves every captured image into a specified directory of your choice using a common file name. Each image file is numbered and can start at any number and have a specified number of digits.

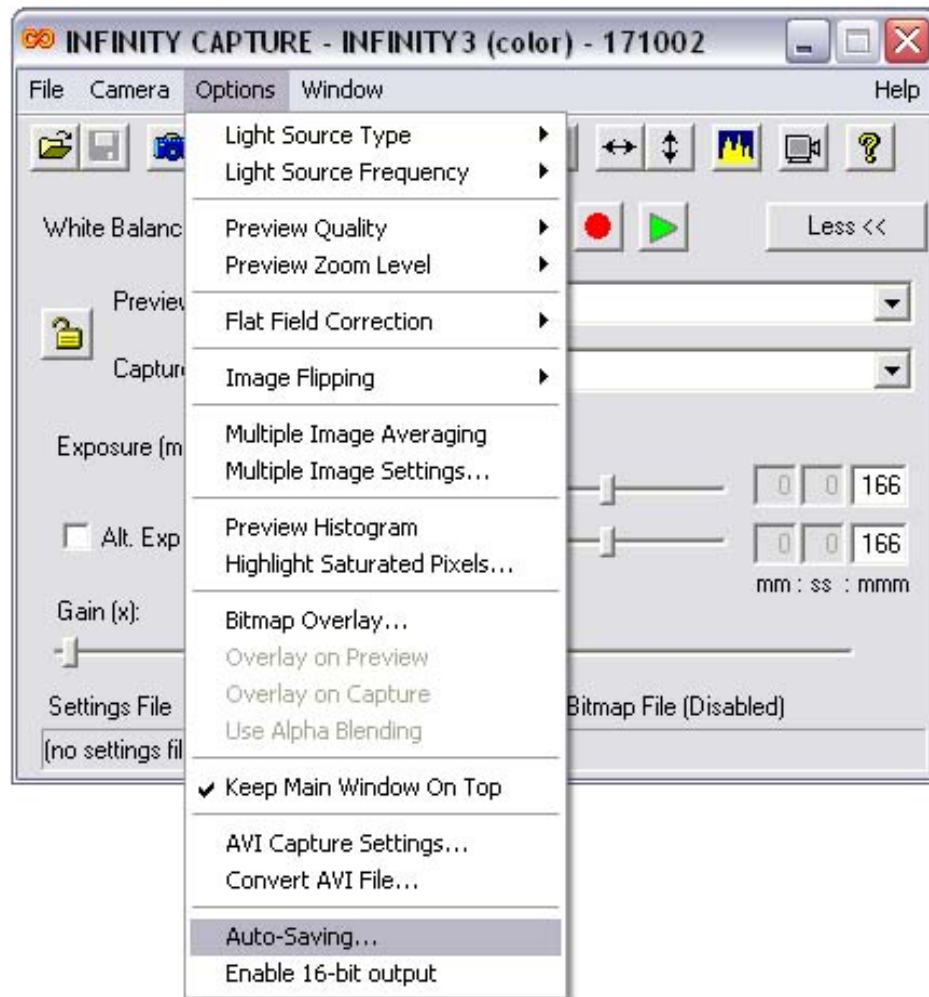


Figure 21 - Auto-Saving Option

The auto-saving dialog provides some options to how the files are saved. The save directory, filenames and file types can be selected. You can choose to overwrite any existing file or continue from an existing set of captured images.

Each saved image will have the same filename with an appended number. This number can start anywhere and can have any number of digits. The only restriction is that the final filename (filename, digits and extension) must not exceed your operating system's filename size limit (typically 256 characters).

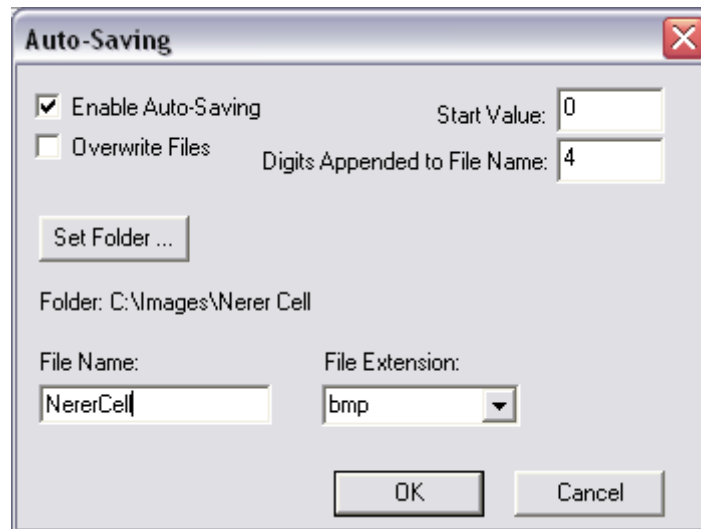


Figure 22 - Auto-Saving Dialog

3.6.17 INFINITY3 Camera Cooler Control

All the new INFINITY3 based cameras are able to cool down the sensor to improve its noise response with longer exposures. To turn on this feature, select the Cooler On option of the Camera menu. The blue light on the front of these cameras indicates when the camera coolers are on and running.

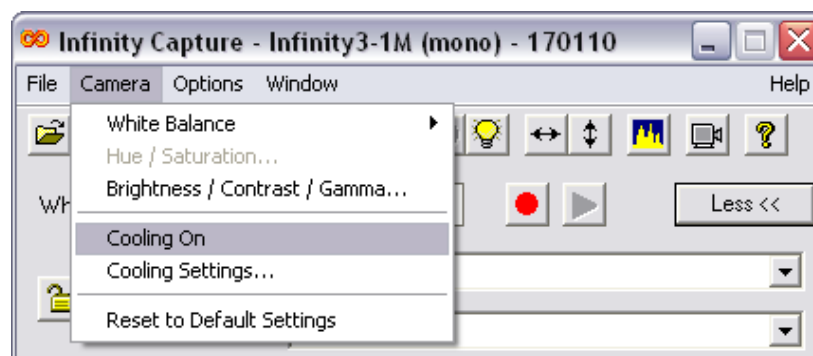


Figure 23 - INFINITY3 Camera Cooler Option

These cameras can also report their current sensor temperature. The Cooler Settings... option provides the current sensor temperature of the camera. These cameras are able to cool to about 30°C below ambient temperature of the camera surroundings.

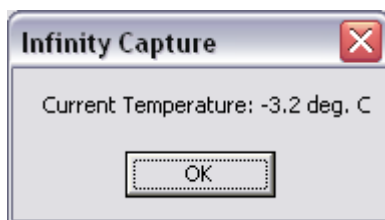
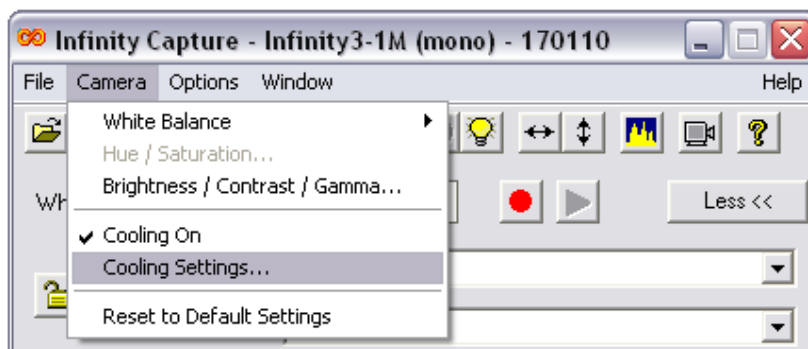


Figure 24 - Cooling Settings Option and Dialog

3.6.18 AVI Capture Settings

Not only can you capture individual images but you can capture a video clip from the camera and save it to an AVI file.

To begin capturing video clips, first configure the AVI capture settings. Hitting the API Capture Settings button brings up the dialog shown in Figure 25.

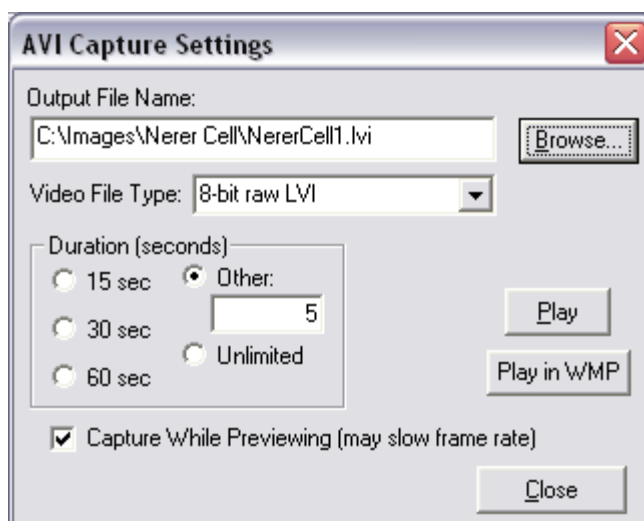


Figure 25 - AVI Capture Settings Dialog

Select a filename and location for the AVI video clip. Next select the video file type for the AVI file. Note there are four types available as shown in Figure 26.

Note: The XviD AVI file type requires the installation of a third-party AVI compression filter. It is available from the following website, www.koepi.org/xvid.shtml. For more information on this AVI compression filter visit www.xvid.org.

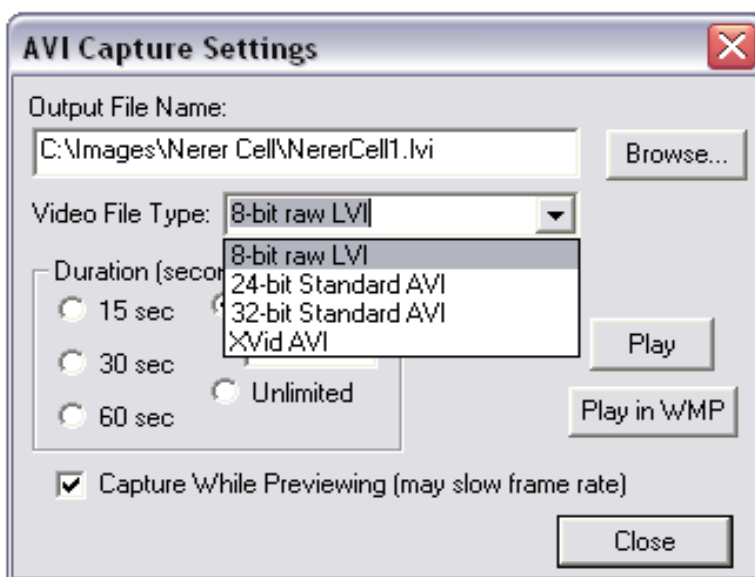


Figure 26 - AVI Video File Types

Select the duration of the video clip you wish to capture. You have the option of having the video preview to the screen while capturing the video clip. Note that having this option selected may slow down the camera frame rate and result in lower frame rates in the captured video clip.

Note: Setting the duration to large values can create extremely large files, depending on the camera resolution and frame rate. To minimize this, you may want to reduce the preview window size when capturing video clips.

3.6.19 Capturing AVI files



Once you have setup the AVI capture settings, you can begin to record your video clips. The video will be saved to a temporary file containing the raw video images captured from the camera. This temporary file can be viewed directly by the INFINITY CAPTURE's AVI File Playback.

Note: To view this file with other AVI playback applications, you will need to convert this file to a standard AVI file or compress it with the XviD filter (see section 3.6.18 for more information on this AVI compression filter).

3.6.20 AVI File Playback



You can playback any type of .avi file with the INFINITY CAPTURE's AVI playback feature. This feature can playback raw files that were captured from your INFINITY camera that have not been converted to a standard AVI file.

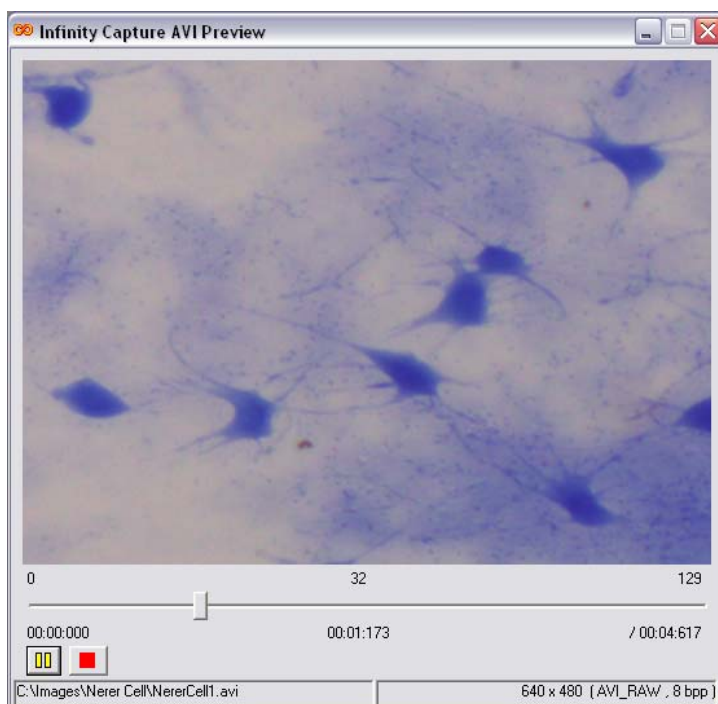


Figure 27 - AVI Playback Dialog

The INFINITY CAPTURE AVI playback dialog allows you to play, pause, stop and scan to any location in the AVI file. You can rewind and fast-forward through the AVI playback through the slider control provided.

3.6.21 Converting AVI files

The INFINITY CAPTURE can capture, convert and save .avi files in one step. You can also capture only the raw data from the camera and convert it at a later date. To do this, select the Convert AVI File... from the options menu.

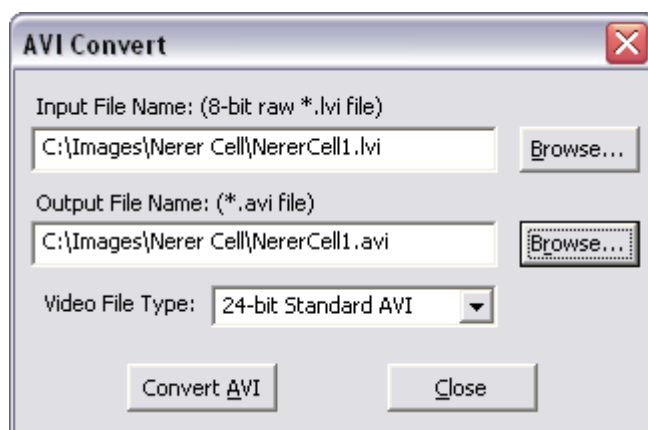


Figure 28 - AVI Convert Dialog

In the Input File Name, select the RAW AVI file that was captured previously, as shown in Figure 28. In the Output File Name, select or provide a destination AVI file name. Finally, select the video file type you want the output file to be and hit the Convert AVI button.

3.7 Using INFINITY Cameras with TWAIN

Many programs support camera control and image capture directly using the standard TWAIN protocol. Paint programs, Microsoft Office applications as well as a wide variety of scientific software applications identify and run the INFINITY cameras through the supplied TWAIN interface.

The operation of the TWAIN interface is virtually identical to the INFINITY CAPTURE application. The only difference is that when you capture an image, instead of displaying in on screen, it passes it to the underlying TWAIN enabled application. There is no facility to save images directly to a file using the TWAIN interface.